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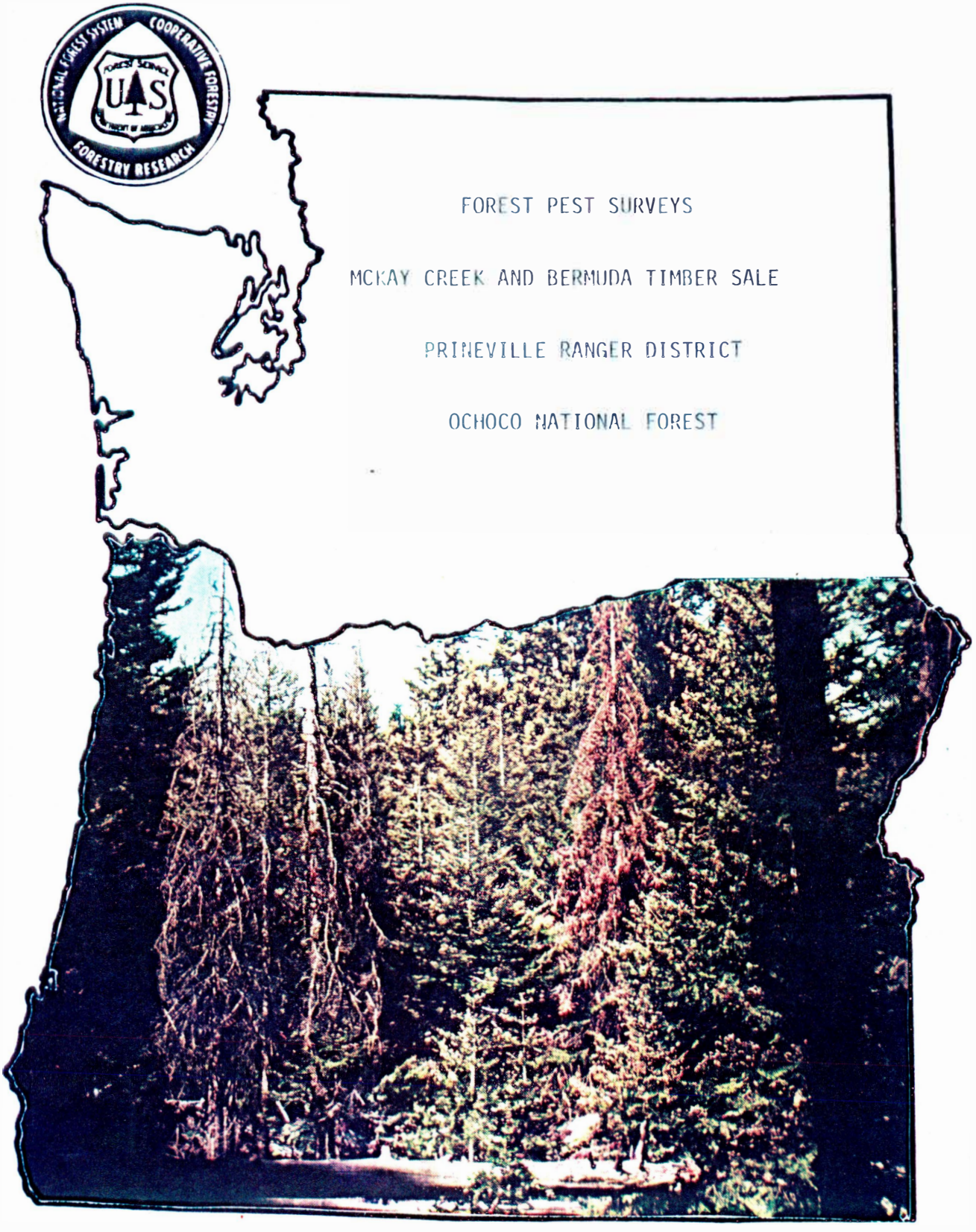
Forest Pest Management
Pacific Northwest Region



FOREST PEST SURVEYS

MCKAY CREEK AND BERMUDA TIMBER SALE

PRINEVILLE RANGER DISTRICT

OCHOCO NATIONAL FOREST

FOREST PEST SURVEYS IN THE McKAY CREEK AND BERMUDA TIMBER SALES PRINEVILLE RANGER DISTRICT, OCHOCO NATIONAL FOREST

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At the request of Dave Owen, District Silviculturist, a Forest Pest Management pathology crew visited the Prineville Ranger District during the week of July 22 to 25. Purposes of the trip were to examine portions of two timber sales, determine distribution, and relative severity of diseases and insects, and provide pest management recommendations. Areas evaluated were in the Bermuda Timber Sale (T. 17 S., R. 18 E., sec. 25, 26, 35, 36; T. 17 S., R 19 E., sec. 28, 29, 30, 32; and T. 18 S., R. 18 E., sec. 2) and McKay Creek Planning Area (T. 12 S., R. 17 E., sec. 11, 12, 13, 14, 15, 24).

Bermuda Timber Sale

Overstories on this timber sale are composed of old-growth ponderosa pine intermixed with large, old Douglas-fir. Understories are mostly Douglas-fir with a small amount of ponderosa pine. The District is considering the possibility of overstory removal with understory retention in several harvest units and there is concern about pest potential in the understories. This is especially true on the steeper units where cable logging systems would be employed and a substantial amount of physical damage to residual trees might be anticipated.

Fourteen cutting units (numbers 4, 11, 13, 15, 17, 19, 35, 36, 37, 38, 40, 41, 43, and 46) totaling 300 acres were examined by the FPM crew. A series of transects approximately two chains apart were run across each unit, notes were taken on pest conditions, and a map of the pest distribution was prepared.

Douglas-fir understories in all units were found to be infected by Douglas-fir dwarf mistletoe (Arceuthobium douglasii). Levels of infection varied somewhat among the units (Figures 1 - 11), but tended to be high. Some ponderosa pine dwarf mistletoe (A. campylopodum) also was observed.

The dwarf mistletoes are parasitic higher plants that are quite host-specific. In the survey area, Douglas-fir dwarf mistletoe infects only Douglas-fir, and ponderosa pine dwarf mistletoe infects only ponderosa pine. Spread is by forcibly discharged seeds that are shot out from mature female plants and fall into the crowns of other trees below the host tree. Thus, conditions in multi-storied stands such as those on the Bermuda Sale are particularly favorable for dwarf mistletoe spread and buildup. On the average, Douglas-fir dwarf mistletoe seeds are shot out a distance of 10 feet. At the most, they may travel 30 feet outward. Ponderosa pine dwarf mistletoe plants are larger and cast their seeds further than do Douglas-fir dwarf mistletoes. On the average, their seeds travel 35 feet. Once a mistletoe seed lands on susceptible host foliage, its sticky coating allows it to slide down to the twig and

adhere at the base of a needle. The seed then germinates and produces an infection peg that grows into the host tissue. With time, the mistletoe plant develops both aerial shoots and a sinker system (comparable to a root system) incorporated within the host. The dwarf mistletoe obtains food and water from the host and, at the same time, induces abnormal growth in the tree, resulting in swellings and witches'-brooms.

Effects of dwarf mistletoe differ among host species and can be influenced by location of infections on the tree. Unfortunately, Douglas-fir dwarf mistletoe is almost always extremely damaging. Infections may become systemic and severely debilitate the host no matter where they are located in the crown. They cause considerable growth loss, dramatic stem distortion, frequent top-killing, predisposition to bark beetles, and often tree death. Ponderosa pine dwarf mistletoe may also be quite damaging, but effects are most severe when infections occur in the upper part of the host's crown. Vigorous, young ponderosa pine with dwarf mistletoe infections confined to the lower third of the crown suffer relatively little damage.

Forest Pest Management usually recommends regeneration harvesting for Douglas-fir dwarf mistletoe control in stands such as those on the Bermuda Sale. Since dwarf mistletoes are obligate parasites, they are eliminated when their hosts are clearcut. The site can then be replanted with any tree species desired, including the mistletoe host as long as stand boundaries are kept mistletoe-free. Because of Douglas-fir dwarf mistletoe's exceedingly high damage potential, we prefer not to see infected understories retained for management. However, we recognize that other considerations may make retention of some understories necessary. If this is the case on the Bermuda Sale, FPM recommends that first choice for retention be given to understories with apparent light to moderate mistletoe infection ratings and fairly large trees (Figure 12). Trees saved should be large enough that they would normally reach harvestable size within 20 years. Severely infected understories comprised of very small trees (Figure 13) should not be retained under any circumstances. Small Douglas-fir more than 15 years old that are within 50 feet of infected overstory trees should be considered to be diseased even though infections may not be obvious. Dwarf mistletoe infections can be latent or extremely diffcult to detect on such trees.

Of the stands surveyed, understories in Units 11, 19, 37, 38, 40, 43, and 46 qualify in our estimation to be considered for retention. If any of these understories are retained, FPM further recommends that they be thinned at least 3 years after the overstory removal favoring, by order of priority, (1) apparently mistletoe-free dominant and codominant ponderosa pines, (2) apparently mistletoe-free dominant and codominant Douglas-fir, (3) dominant and codominant ponderosa pines with mistletoe infections limited to the bottom half of the crown, and (4) large dominant and codominant Douglas-fir with few dwarf mistletoe infections (within this group discriminate against trees with large witches'-brooms and infected tops). Stands resulting from the understory retention and subsequent thinning should be harvested by clearcutting as soon as they attain merchantability if mistletoe infections are adversely affecting growth.

McKay Creek Planning Area

Stands on this sale area vary with aspect and topography. Those on the north-facing slopes and along creeks are made up predominantly of grand fir and Douglas-fir with some lodgepole pine, western larch, and ponderosa pine.

Stands on the drier ridges above Road 2720 are composed mostly of ponderosa pine with some Douglas-fir and western larch. There have been at least two past selective harvest entries in the unit. Considerable tree mortality and decline occurs, particularly in portions of the stands in the south-center and southwest corners of the surveyed area. The District would like, if possible, to design harvesting and regeneration prescriptions that would capture loss and minimize future hazard.

The Forest Pest Management crew surveyed about 800 acres (Figure 14) by running transects at three-chain intervals across the unit. Three root diseases, laminated root rot (caused by the fungus Phellinus weirii), Armillaria root disease (caused by Armillaria ostoyae), and annosus root disease (caused by Fomes annosus) were encountered, the first on Douglas-fir and grand fir and the last two on grand fir only. Other diseases found were Douglas-fir dwarf mistletoe, ponderosa pine dwarf mistletoe, and larch dwarf mistletoe (A. laricis).

Laminated root rot was by far the most damaging disease and was widely distributed in the stand (Figure 14). It occurred in distinct, often large infection centers containing numerous windthrown, dead, and symptomatic trees (Figure 15). The disease was easily identified based on the characteristic decay with setal hyphae in the roots and butts of affected trees (Figure 16) and the ectotrophic mycelium that the causal fungus produces on root bark. Laminated root rot is an especially dangerous disease, not only because of its devastating effects on currently-infected trees, but because P. weirii is persistent on the site. The fungus can survive for up to 50 years in roots of old stumps and snags and infect new hosts that become established on the site via root contacts. Infection centers increase in size due to mycelial spread from tree to tree along roots at a rate of about 1 foot per year. Control of laminated root rot is generally attained by cutting all trees of highly susceptible species (grand fir and Douglas-fir) in and within a 50-foot buffer around centers. The areas are then regenerated with tree species that are resistant (ponderosa pine), tolerant (lodgepole pine) or intermediately susceptible (western larch) to laminated root rot.

Armillaria root disease was found scattered throughout the grand fir stands on the unit. It was particularly common along old skid roads and in areas where many residual trees had been injured in the past logging operations. Armillaria root disease was identified based on the characteristic thick, white mycelial fans under the bark of affected host roots and lower stems (Figure 17), the associated rhizomorphs (shoestring-like infective structures), and the stringy, yellow decay. A. ostoyae is a very efficient saprophyte that survives almost everywhere in old stumps and roots. It can infect nearby trees via root contacts or by growing a short distance through the soil. Like

P. weirii, the fungus spreads at a rate of about a foot per year. A. ostoyae exhibits considerable variation in virulence in different areas. In many, including the survey area, it appears to be a rather weak pathogen that affects mostly stressed and injured trees. Though A. ostoyae can infect virtually any conifer species, it is mainly found affecting true firs and Douglas-fir in eastern Oregon. Recommended control for Armillaria root disease is to favor tree species resistant to the disease (especially larch and pines) and to promote and maintain stand vigor.

Annosus root disease was found causing scattered patches of grand fir mortality centered around large (18-inch or greater diameter) grand fir stumps created during previous entries. Annosus root disease is tentatively identified by the reddish-brown stains with uneven margins occurring in roots of infected trees (Figure 18) and by the laminated to stringy advanced decay which lacks setal hyphae and often contains black flecks. Culturing is sometimes necessary to confirm the identity of the pathogen. F. annosus is spread by windborne spores. Fruiting bodies, found in hollow stumps (Figure 19), produce large numbers of spores that can be blown long distances. If spores land on freshly-cut stump surfaces or recently created wounds, they germinate, and the fungus colonizes the stump or tree. It then grows through the root system and, hence, across grafts and contacts into the roots of nearby healthy trees. Infection usually results in tree death. Disease centers develop as the pathogen progressively spreads across tree roots into the surrounding stand at a rate of about 1 foot per year. There is strong evidence that F. annosus does not readily cross over to other conifer species from infected true fir. Thus, annosus root disease control can be attained by favoring other tree species over true firs. This approach is especially attractive in stands like those on the McKay Creek unit where many large F. annosus-infected true fir stumps already exist. Treatment of new stump surfaces with sodium borate (borax) prevents infection by F. annosus, but the chemical must be applied within 48 hours of cutting. It does not control the disease in already infected stumps. Stump treatment is a good control technique to use in previously unaffected areas where continued management of grand fir is desired.

Dwarf mistletoe had a scattered distribution in the McKay Creek stands. Douglas-fir dwarf mistletoe was the most common. It occurred with greatest frequency in the southeast and south-center of the surveyed area. Ponderosa pine and larch dwarf mistletoe occurred on relatively few trees, mainly in the northeast portion of the unit. As discussed for the Bermuda Sale, dwarf mistletoes can be controlled by clear-cutting infected stands. Another option involves selective removal of host trees while retaining nonhosts in mixed stands. Seed tree cuts can be employed in dwarf mistletoe-infected stands if nonhosts are retained as seed trees or if infected host seed trees are removed before the new understory is 10 years old or 3 feet tall.

Based on consideration of the pest complexes encountered in our survey, Forest Pest Management recommends the following treatments for stands in the McKay Creek Unit:

(1) Areas affected by laminated root rot (mapped in Figure 14) and buffers of at least 50 feet around them should be clearcut. Replant these areas with ponderosa pine, lodgepole pine, western larch, or mixtures of these species. Discriminate against any naturally regenerating Douglas-fir or grand fir in future thinnings.

(2) In fir-dominated stands not affected by laminated root rot, consider either (a) clear-cutting stands and replanting with Douglas-fir, ponderosa pine, lodgepole pine, western larch, or a mix of these species or (b) doing seed tree cuts, retaining Douglas-fir, pines, or larch as seed trees. If any dwarf mistletoe-infected Douglas-fir, ponderosa pine, or western larch are kept as seed trees, remove them before regeneration reaches a height of 3 feet or age 10 years (whichever happens first).

(3) In the pine-dominated stands on the north part of the unit, there are few pest problems and, from the point of view of pest management, these are the stands least in need of treatment. If seed tree cuts are to be done in any of these stands, favor trees without dwarf mistletoe as seed trees. If mistletoe-infected trees, especially Douglas-fir, must be used as seed trees, remove them before regeneration reaches 10 years of age or a height of 3 feet. If any stands are to have an overstory removal with the understory retained, we would recommend a thinning at least 3 years after the harvest entry. Whenever possible, trees without dwarf mistletoe should be favored leave trees. Douglas-fir with <u>any</u> mistletoe and ponderosa pine or western larch with dwarf mistletoe infections in the upper half of the crown should not be retained as crop trees.

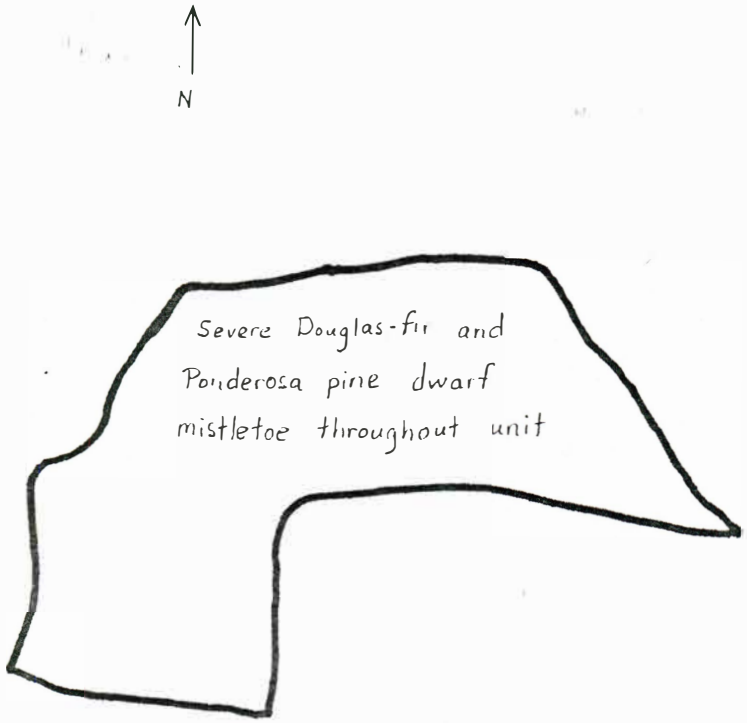

Fig. 1.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 4, Bermuda Timber Sale.

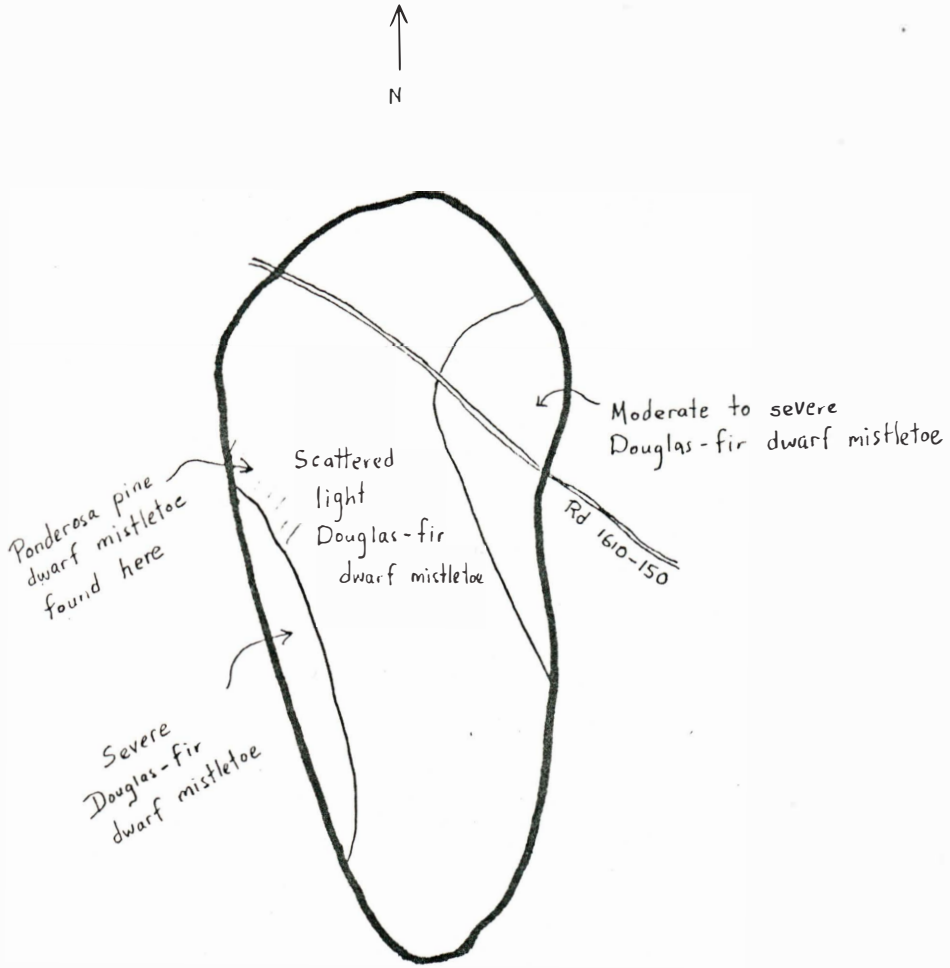

Fig. 2.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 11, Bermuda Timber Sale.

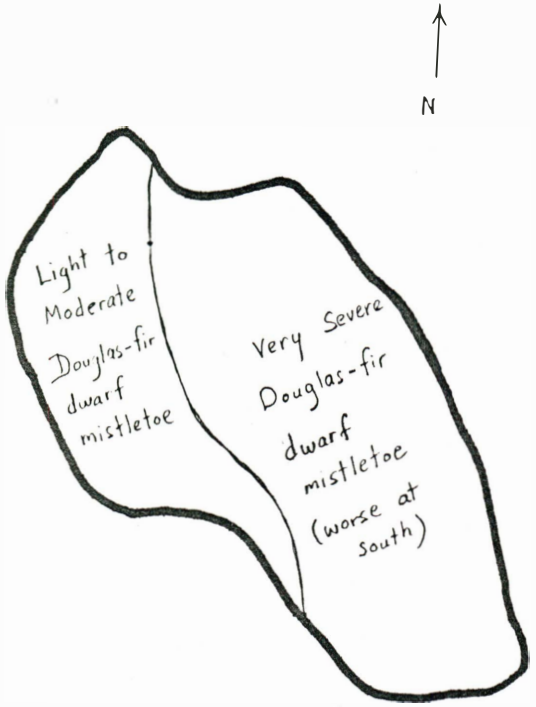

Fig. 3.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 13, Bermuda Timber Sale.

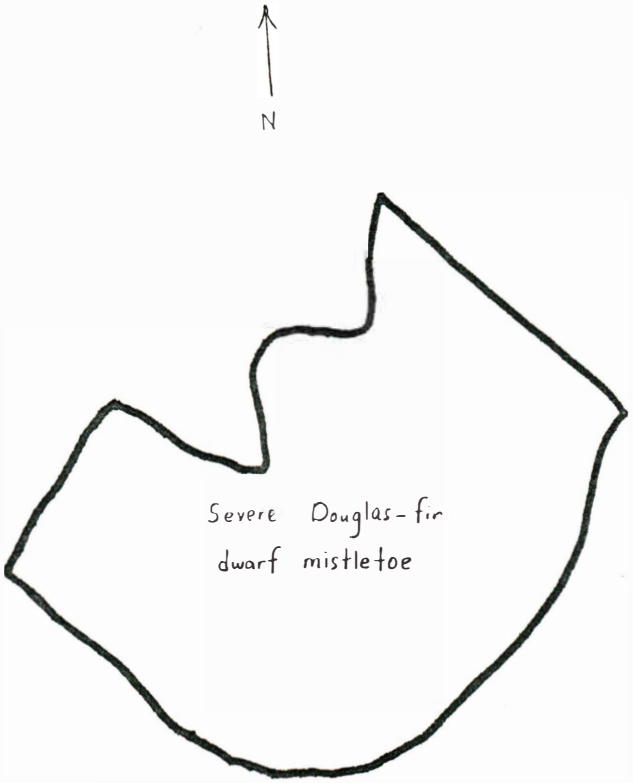

Fig. 4.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 15, Bermuda Timber Sale.

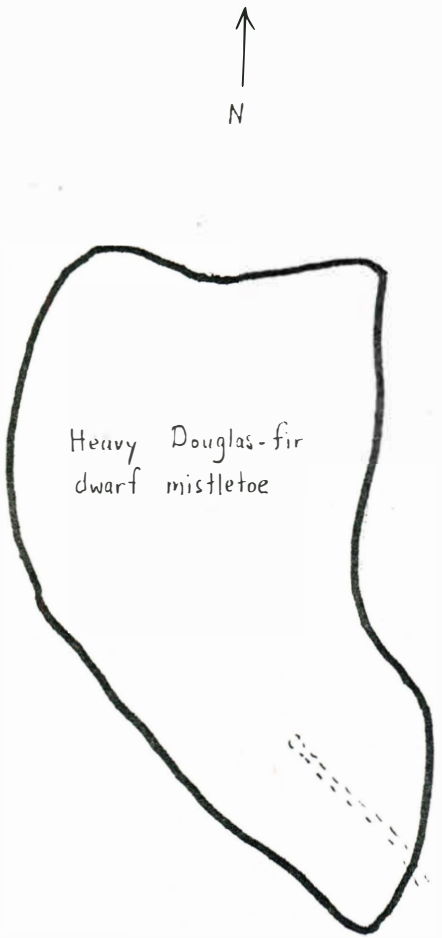

Fig. 5.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 17, Bermuda Timber Sale.

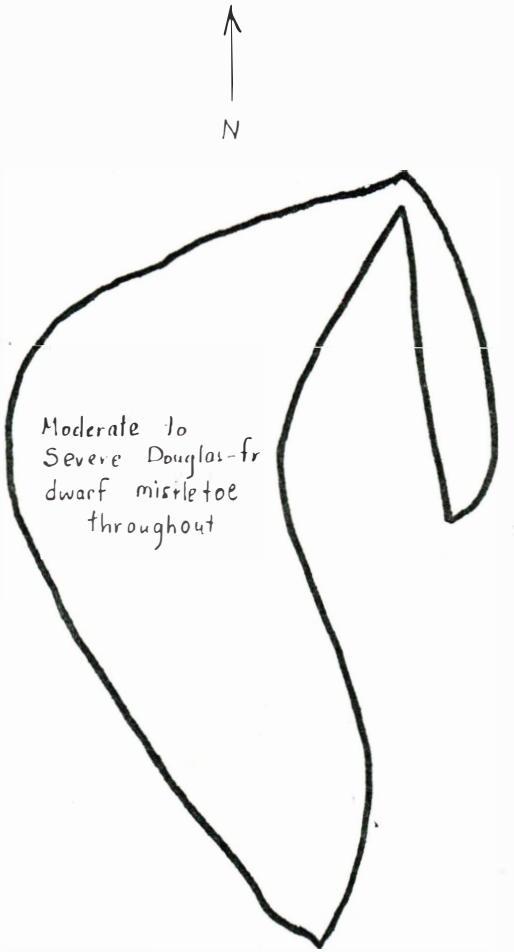

Fig. 6.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 19, Bermuda Timber Sale.

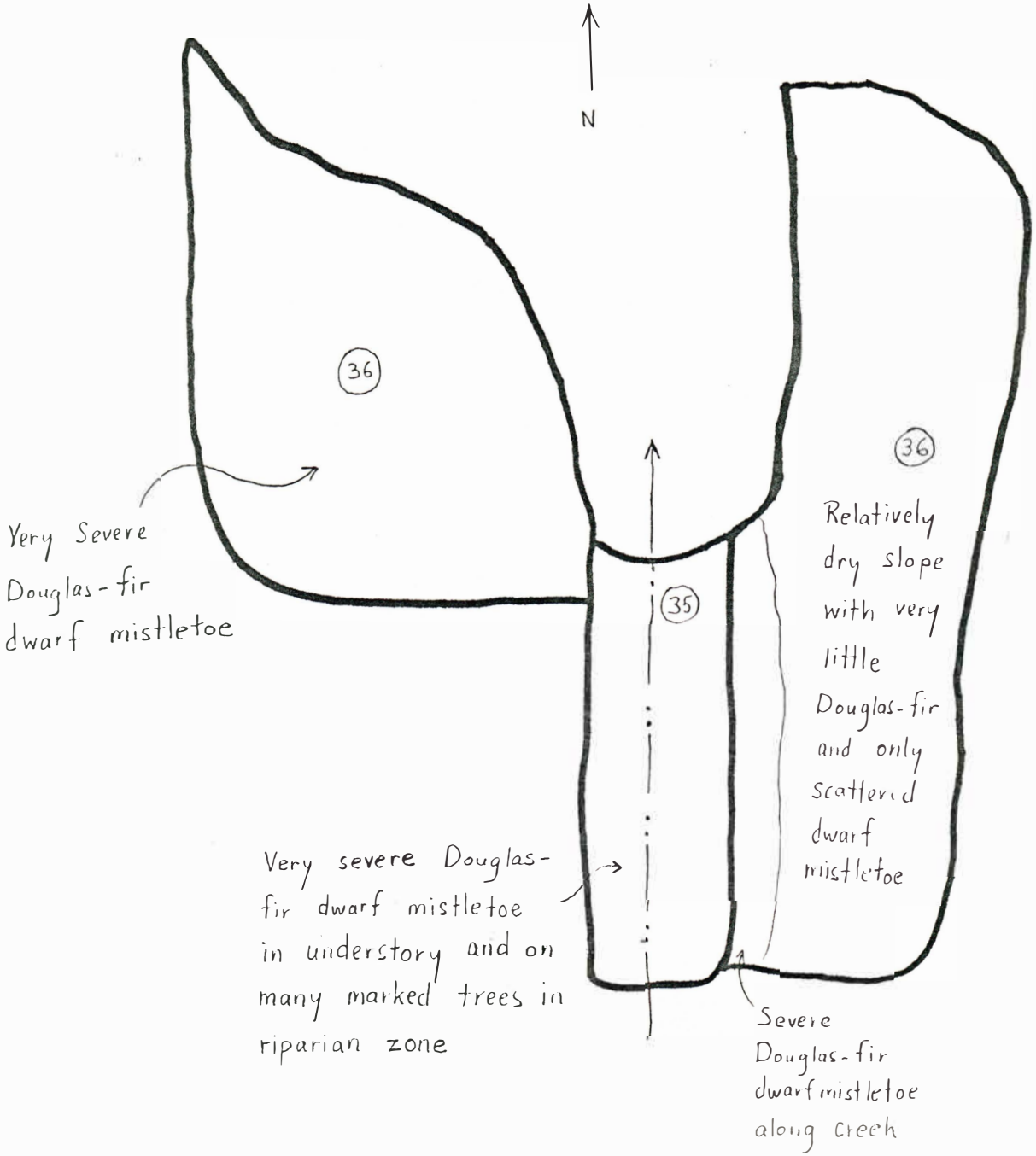
N
36
Very Severe Douglas-fir dwarf mistletoe
35
36
Relatively dry slope with very little Douglas-fir and only scattered dwarf mistletoe
Very severe Douglas-fir dwarf mistletoe in understory and on many marked trees in riparian zone
Severe Douglas-fir dwarf mistletoe along creek

Fig. 7.--General distribution and severity rating of dwarf mistletoe in the understories of Units 35 and 36, Bermuda Timber Sale.

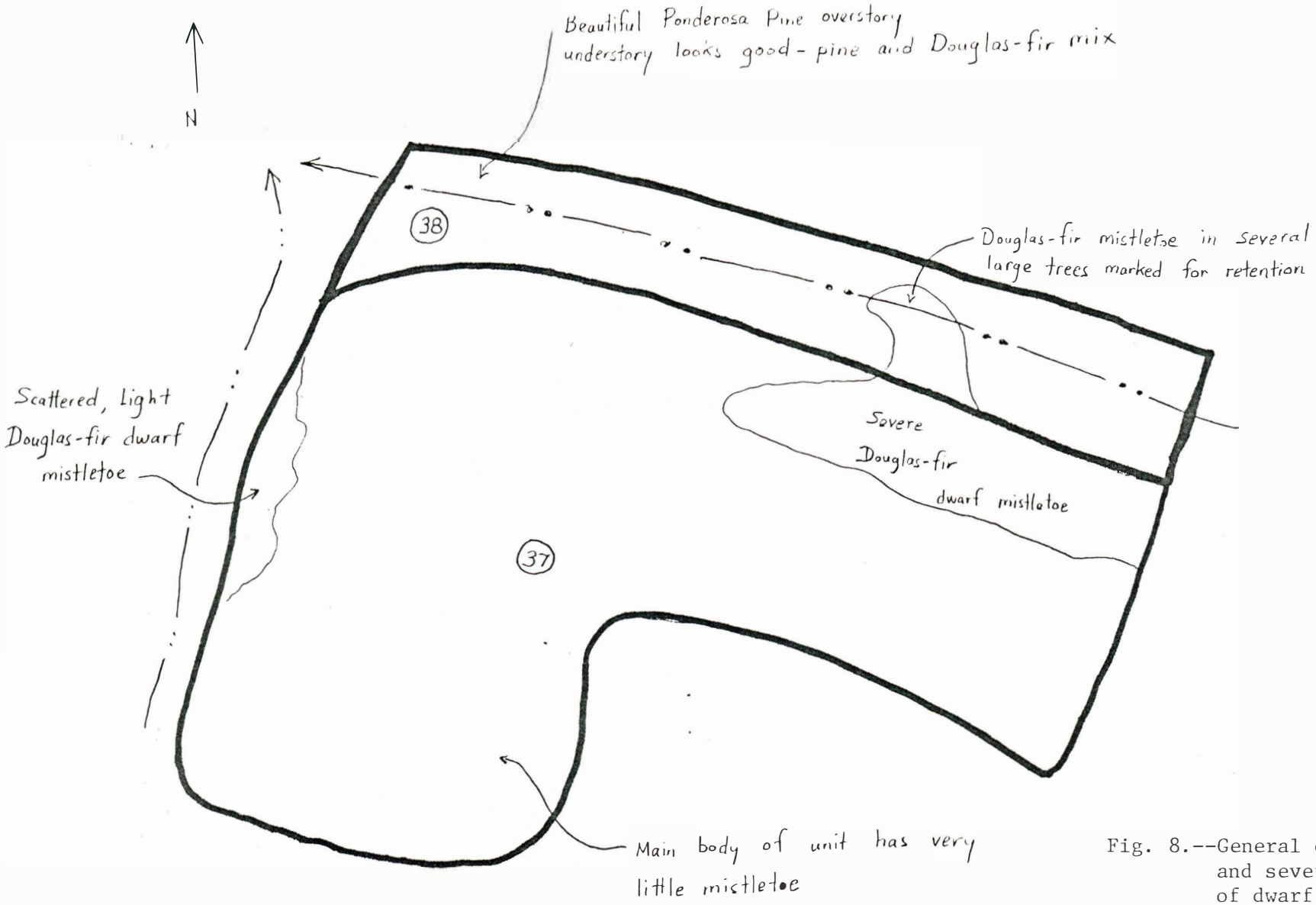
N
Beautiful Ponderosa Pine overstory
understory looks good - pine and Douglas-fir mix
38
Douglas-fir mistletoe in several large trees marked for retention
Scattered, light Douglas-fir dwarf mistletoe
Severe Douglas-fir dwarf mistletoe
37
Main body of unit has very little mistletoe

Fig. 8.--General distribution and severity rating of dwarf mistletoe in the understories of Units 37 and 38, Bermuda Timber Sale.

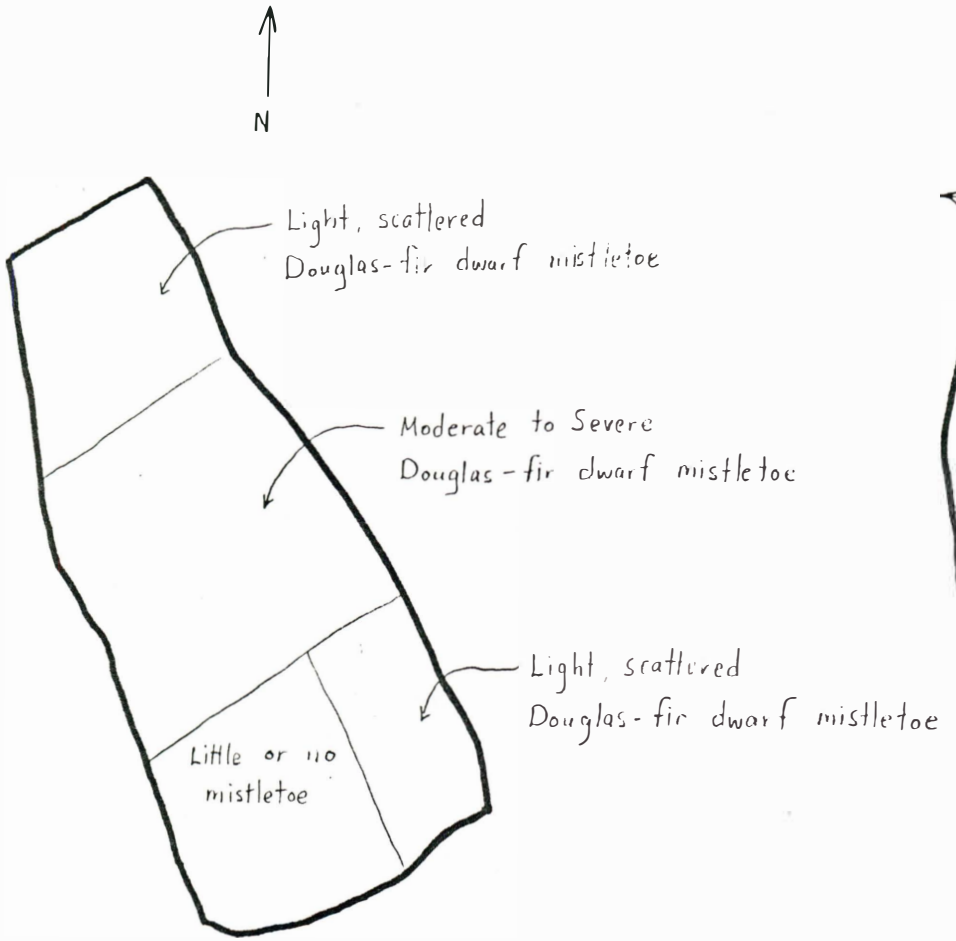

Fig. 9.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 40, Bermuda Timber Sale.

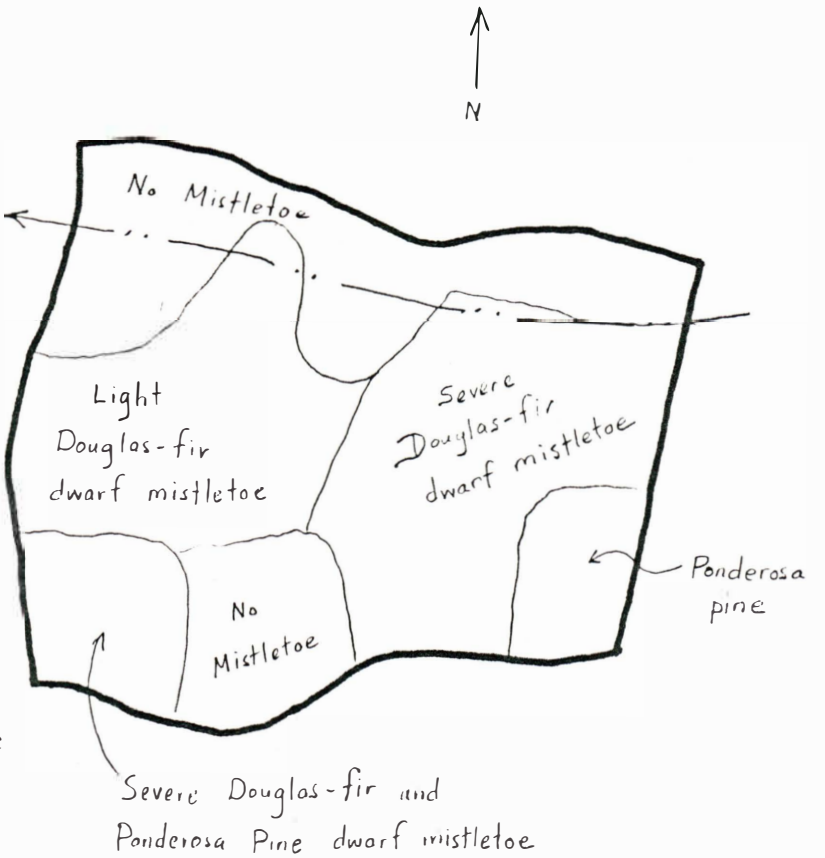

Fig. 10.--General distribution and severity rating of dwarf mistletoe in the understory of Unit 41, Bermuda Timber Sale.

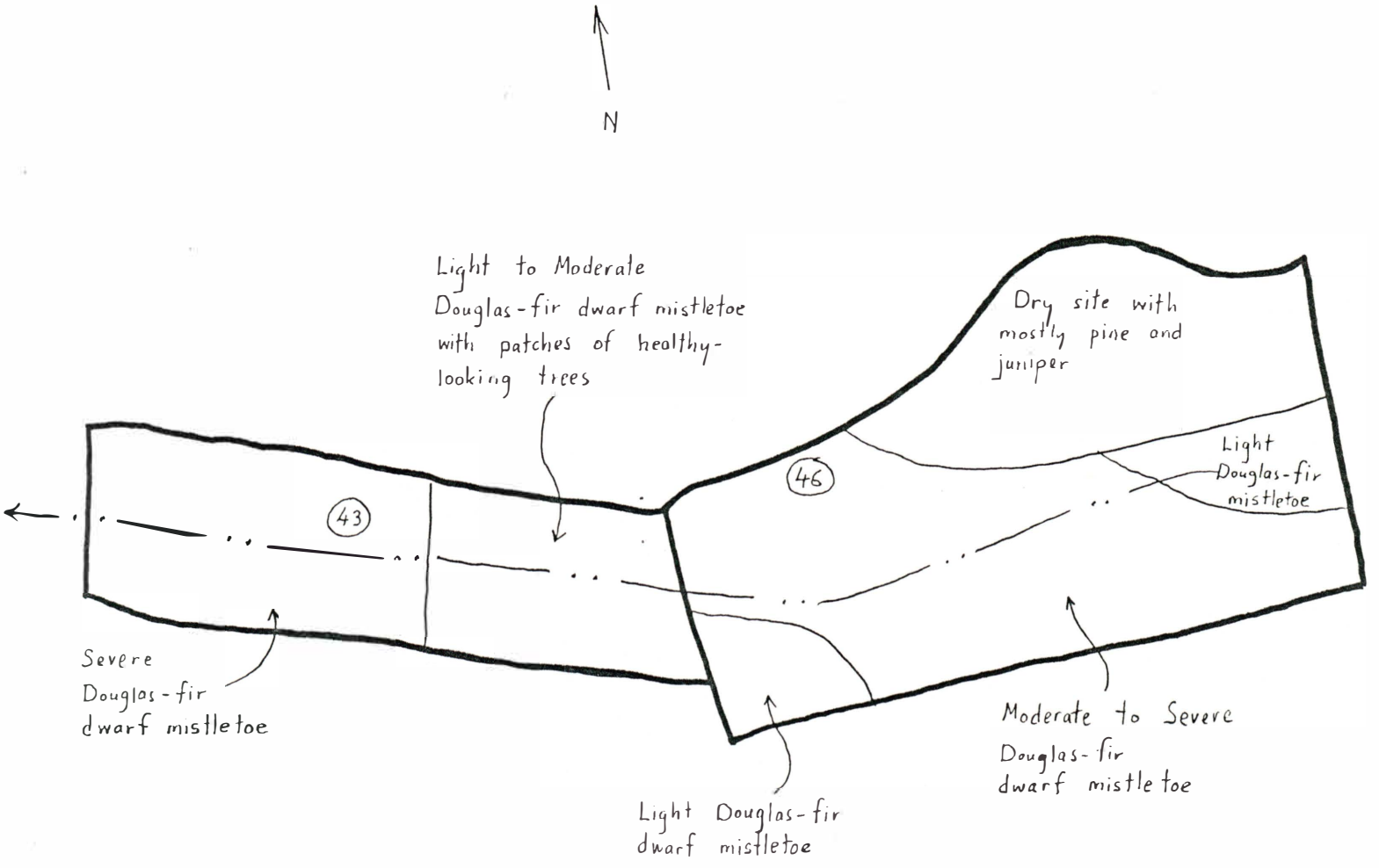

Fig. 11.--General distribution and severity rating of dwarf mistletoe in the understories of Units 43 and 46, Bermuda Timber Sale.

Figure 12: Dwarf mistletoe-infected Douglas-fir understory that might be considered for retention after an overstory removal. Trees are fairly large and most do not have top infections or large witches'-brooms. If retained, the resulting stand should be clearcut as soon as merchantability is attained.

Figure 13: Young, Douglas-fir understory with severe dwarf mistletoe infection. Understories such as this should never be retained for management.

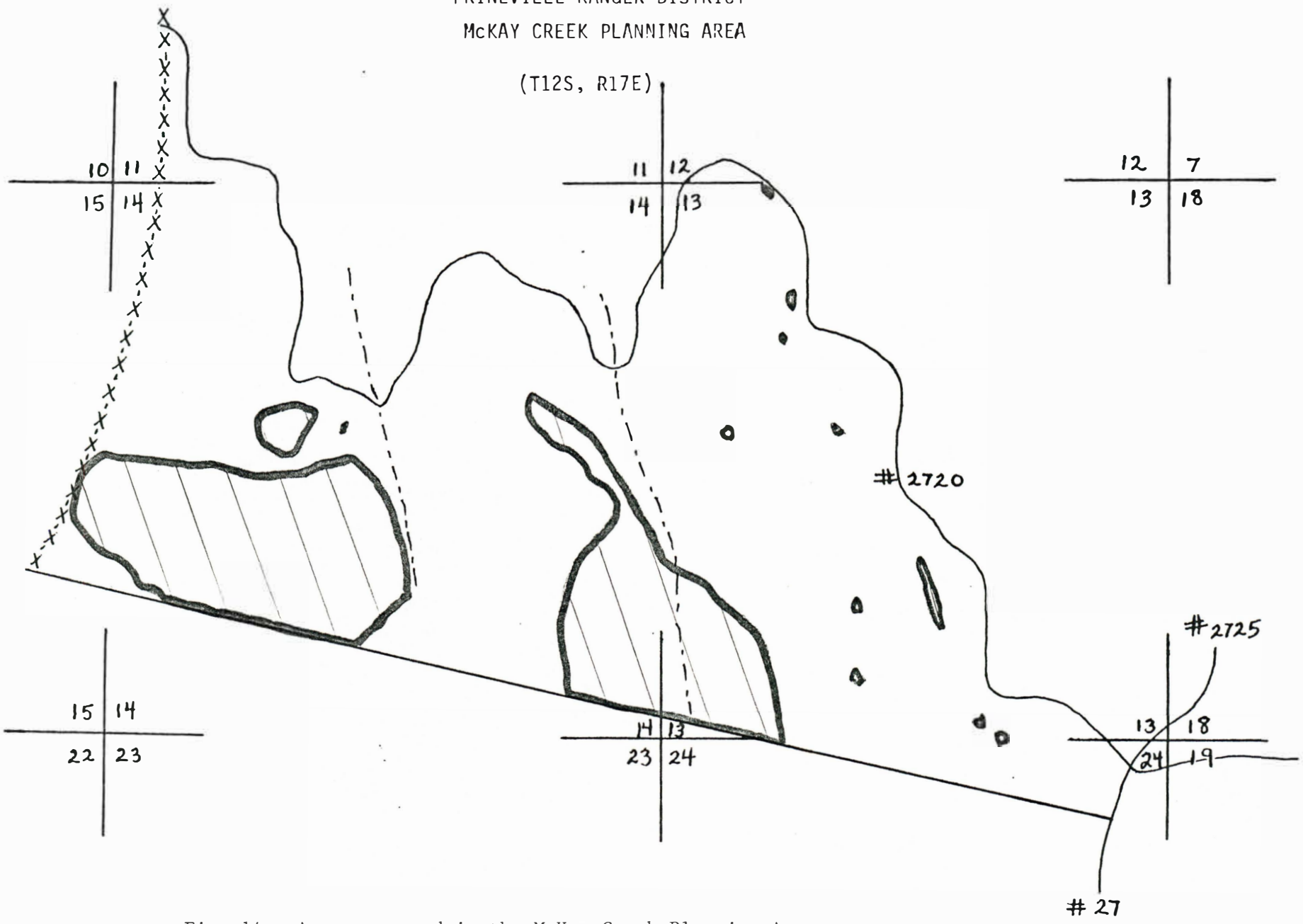

Fig. 14.--Area surveyed in the McKay Creek Planning Area showing distribution of laminated root rot centers.

Figure 15: Typical laminated root rot pocket in the McKay Creek area. Note opening in the stand, windthown trees with roots rotted off to form "root balls," dead standing and declining trees. Some trees also exhibit light to moderate spruce budworm defoliation.

Figure 16: Characteristic laminated decay caused by P. weirii. Wood separates readily along the growth rings and reddish, whiskery setal hyphae occur between the layers of rotted wood.

Figure 17: Mycelial fans under bark of tree infected by A. ostoyae.

Figure 18: Reddish-brown stain with irregular margin caused by F. annosus in grand fir root.

Figure 19: F. annosus conk pulled out of hollow in large, infected grand fir stump. Stumps of this kind frequently serve as foci for annosus root disease centers.

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